

What is claimed is:

1           1.    An apparatus comprising:  
2           a first cell frame;  
3           a second cell frame; and  
4           a compartment formed between the first cell frame and  
5 the second cell frame, the compartment to house an anode, a  
6 cathode and a first membrane positioned between the anode  
7 and the cathode.

1           2.    The apparatus of claim 1 further comprising a  
2 plurality of screen spacers including a first screen spacer  
3 positioned between the anode and the first membrane and a  
4 second screen spacer positioned between the cathode and the  
5 first membrane.

1           3.    The apparatus of claim 1, wherein the anode is  
2 configured as a self-supporting screen including at least  
3 one connector for attachment to a bus bar situated on a top  
4 edge of the first cell frame.

1           4.    The apparatus of claim 3, wherein the cathode is  
2 configured as a mesh screen having at least one connector  
3 protruding from the mesh screen for coupling with a bus bar  
4 on a top edge of the second cell frame.

1           5.    The apparatus of claim 4, wherein at least one  
2 sidewall of the second cell frame is either translucent or  
3 transparent.

1           6.    The apparatus of claim 1 being a membrane  
2 electrolysis (ME) unit to recover chemical elements.

1           7.    The apparatus of claim 1 being a membrane  
2 electrolysis (ME) unit to remove a chemical element from a  
3 process solution for recycling of the chemical element.

1           8.    The apparatus of claim 2 further comprising:  
2           a first clamping frame situated adjacent to the first  
3 cell frame so that the first cell frame is between the first  
4 clamping frame and the first screen spacer;  
5           a second clamping frame situated adjacent to the second  
6 cell frame so that the second cell frame is between the  
7 second clamping frame and the second screen spacer;  
8           a plurality of fastening rods inserted through  
9 apertures of the first clamping frame and the second  
10 clamping frame; and  
11           a plurality of fastening components each positioned on  
12 a corresponding end of one of the plurality of fastening  
13 rods.

1           9.    The apparatus of claim 8, wherein each of the  
2 plurality of fastening components is threaded on the  
3 corresponding end of the one of the plurality of fastening  
4 rods.

1           10.   The apparatus of claim 8, wherein the second  
2 clamping frame includes an opening to enable viewing of at  
3 least one sidewall of the second cell frame being either  
4 translucent or transparent.

1           11.   The apparatus of claim 1, wherein the second cell  
2 frame further comprises an in-flow port and an out-flow port

3 both placed along a perimeter of the second cell frame, the  
4 out-flow port positioned above the in-flow port.

1 12. The apparatus of claim 2, wherein the compartment  
2 formed by the first cell frame and the second cell frame to  
3 further house a non-conductive frame, a third spacer  
4 positioned between the non-conductive frame and the first  
5 membrane, a second membrane positioned between the second  
6 spacer and the non-conductive frame, and a fourth spacer  
7 positioned between the non-conductive frame and the second  
8 membrane.

1 13. The apparatus of claim 4, wherein the second cell  
2 frame includes an end wall that is either transparent or  
3 translucent to enable viewing of the cathode.

1 14. An apparatus comprising:  
2 a first cell frame including a first compartment  
3 housing an anode; and  
4 a second cell frame including a second compartment  
5 housing a cathode,  
6 wherein the first compartment and the second  
7 compartment collectively form a compartment to additionally  
8 house at least (i) a first membrane positioned between the  
9 anode and the cathode and (ii) a first spacer positioned  
10 between the cathode of the second cell frame and the first  
11 membrane.

1 15. The apparatus of claim 14 further comprising a  
2 second spacer positioned between the anode and the first  
3 membrane.

1        16. The apparatus of claim 15 further comprising a  
2 third cell frame including an anode, a fourth cell frame  
3 including a cathode, and a non-conductive frame interposed  
4 between (1) the first cell frame and the second cell frame,  
5 and (2) the third cell frame and the fourth cell frame.

1        17. The apparatus of claim 16, wherein a sidewall of  
2 both the first cell frame and the fourth cell frame is  
3 either translucent or transparent.

1        18. The apparatus of claim 14 being a membrane  
2 electrolysis (ME) unit to recover chemical elements.

1        19. A system comprising:  
2        a unit containing a process solution including chemical  
3 elements to be recovered;  
4        a process line in fluid communications with the unit;  
5 and  
6        a membrane electrolysis (ME) unit in fluid  
7 communications with the unit via the process line, the ME  
8 unit comprising  
9        a first cell frame including a first compartment  
10       that houses an anode, and  
11       a second cell frame including a second compartment  
12       that houses a cathode and faces the first compartment,  
13       wherein the first compartment and the second  
14       compartment collectively form a compartment to  
15       additionally house (i) at least a first membrane  
16       positioned between the anode and the cathode, (ii) a  
17       first spacer positioned between the cathode of the

18        second cell frame and the first membrane, and (iii) a  
19        second spacer positioned between the anode of the first  
20        cell frame and the first membrane.

1        20. The system of claim 19, wherein the unit comprises  
2        a holding container with a connector for adaptation to the  
3        process line.